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(56) Documents Cited
GB 0520366 A US 5069139 A US 5038684 A
US 4336756 A US 3795196 A

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(54) **Method for the manufacture of a projectile, and a projectile**

(57) A projectile comprises a core 2 and a jacket 1 surrounding the core. It is the object of the present invention to provide a solution by which as uniform projectiles as possible may be made rapidly and simply of as few structural parts as possible. In the invention, grip means 12 are arranged on the projectile core 2, and corresponding receiving means eg notches 9 are arranged in the jacket 1. The co-operation of such means 9, 12 eliminates a relative movement between the jacket 1 and the core 2 when the core is arranged within the jacket.

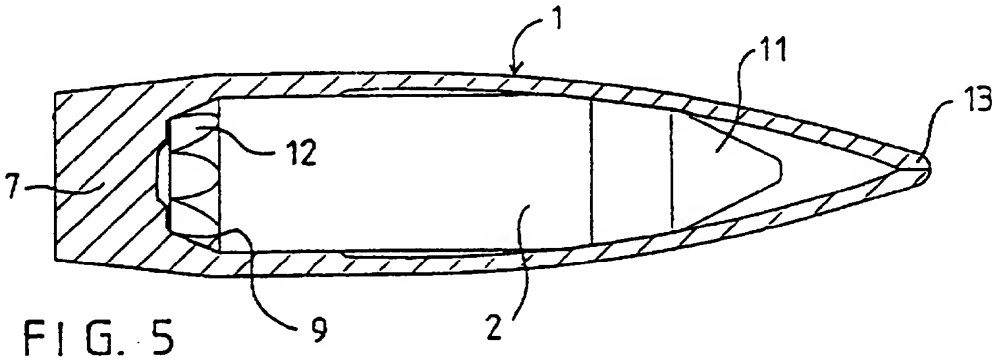

FIG. 5

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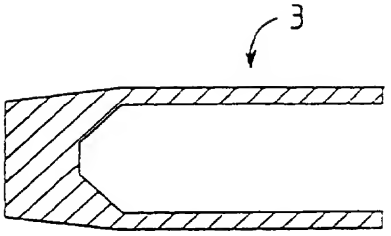

FIG. 1

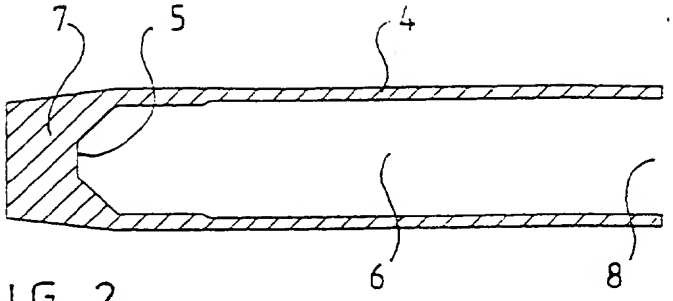

FIG. 2

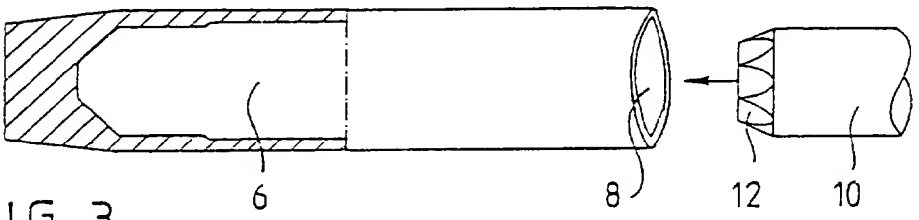

FIG. 3

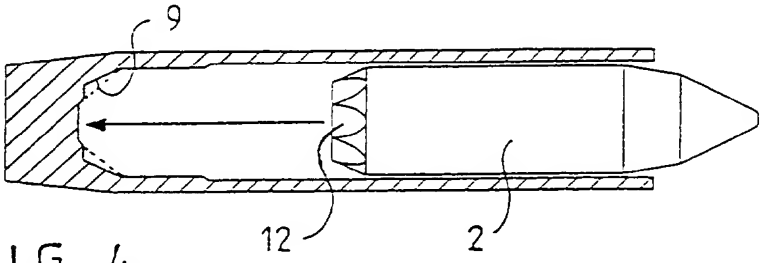

FIG. 4

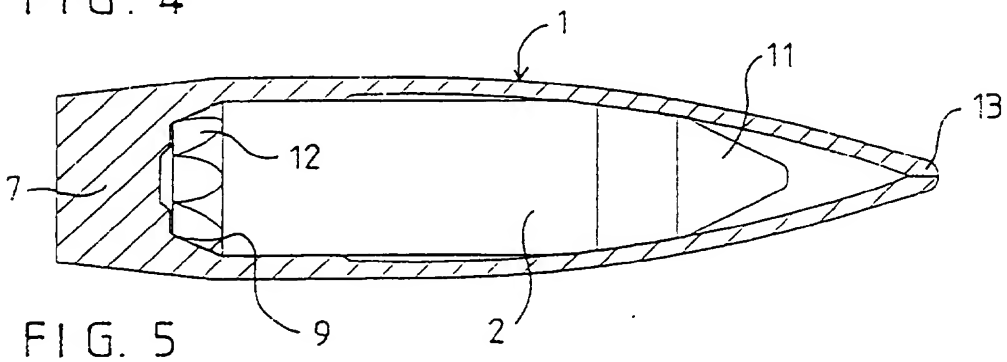

FIG. 5

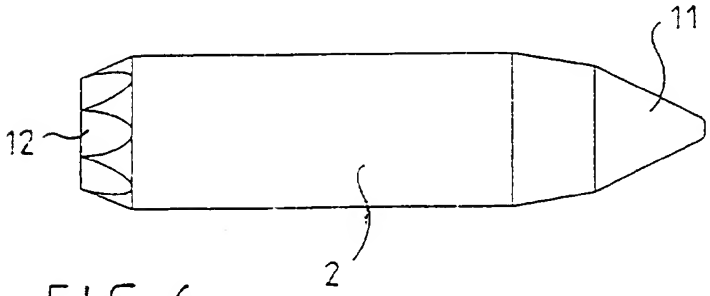

FIG. 6

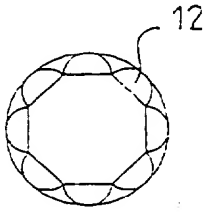

FIG. 7

METHOD FOR THE MANUFACTURE OF A PROJECTILE, AND A PROJECTILE

The present invention relates to a method for the manufacture of a projectile comprising a jacket and a core.

The invention also relates to a projectile manufactured with the method described.

It is previously known to manufacture projectiles, particularly those comprising a hard metal core, e.g. by forming a jacket portion with a nose of a copper mixture or copper coated steel. A core performing the actual penetration is provided within the jacket. The projectile core is centred in a cavity provided by the jacket such that the nose of the core is pressed against the front portion of the jacket. Thereafter the core is centred in the jacket cavity by a cup made of aluminium or other similar material and disposed at the open rear portion of the jacket. Such solutions are known from e.g. publications SE 116804 and SE 116856. Such a cup serves not only to centre the core but also to fill the empty space left between the jacket and the core.

Another conventional way to make similar so-called armour projectiles is to arrange the core in a cup-like jacket that is open at the nose of the projectile. Such a solution is known e.g. from publication NO 164131. Thereafter the jacket is usually provided with a separate nose portion that centres the projectile in the jacket and is made e.g. by traction of a copper mixture.

In addition to a rear or front portion arranged in connection with the core, at times separate support rings have to be employed to centre and lock the core immobile in the jacket.

The problem with these prior solutions has, however, been that centring the projectile core is extremely difficult and laborious, and can even occasionally fail.

In addition, making a projectile of three, even four, parts is expensive and time-consuming. It is difficult to maintain the dimensional accuracy and accurate joining of these various structural parts in order to eliminate balancing problems. Dimensional variations in the rear portion, for example, essentially affect the performance of the projectile upon firing, whereby it is vital to retain a uniform shape. When a projectile is made of a separate jacket covering the front portion and a separate rear portion, the rear portion of the projectile is often subjected to dimensional variations.

It is an object of the present invention to eliminate prior art drawbacks and to provide a novel solution by which as uniform projectiles as pos-

sible may be made rapidly and simply of as few structural parts as possible.

This aim is achieved by a method for the manufacture of a projectile conforming with the characteristics disclosed in the claims of the present invention. More exactly, the method according to the present invention is chiefly characterized in that a cup-like billet is made of metal, whereby a jacket is provided by the billet, the jacket comprising a base and an essentially cylindrical wall attached to the base and surrounding a cavity which has a bottom at the end facing the base, and that further, an elongate, essentially cylindrical or polyhedral projectile core is also made of metal, a first end of the core being provided with a tapered nose, and a second end being provided with grip means, and that receiving means for receiving the grip means are arranged in the area of the jacket bottom, and the core is arranged in the jacket cavity from an opening in the billet such that the end comprising the grip means is guided to the receiving means receiving the grip means and thereafter the core nose is encapsulated by the jacket end facing the opening, and the projectile nose end is given the desired shape.

Thus the invention is based on the realization that by arranging interlinked means in the jacket and the core, any movement between them is eliminated and thus the manufacturing process of the projectile becomes significantly simpler.

In this way a projectile is provided which has the characteristics defined in the claims of the present invention. More exactly, the projectile according to the present invention is mainly characterized in that the jacket comprises a base and a cylindrical wall attached to the base and surrounding a cavity, whereby the base end of the cavity comprises a bottom with receiving means, the cavity being provided with an elongate cylindrical or polyhedral core, whereby a first end of the core comprises a nose and a second end comprises grip means arranged in the receiving means at the bottom, and the core nose being encapsulated by the nose portion of the projectile.

Significant advantages are achieved with the method for the manufacture of a projectile and the projectile according to the invention. Thus, the projectile according to the invention is made of only two components, i.e. a jacket and a core. This way a projectile with a simple structure is achieved, the manufacture of which is possible to realize by a simple production technique.

Assembling the projectile using required dimensional accuracy is easy. Thus the projectile, particularly its base portion, is very accurately di-

mensioned providing uniform operating characteristics.

The projectile nose according to the invention is easily shaped as desired in order to provide different operating characteristics.

In the following the invention will be described in more detail by means of the attached drawings, in which

Figure 1 shows a ready formed cup-like jacket billet,

Figure 2 shows the jacket billet after deep drawing of the cylindrical walls,

Figure 3 shows how a tool is led into the billet according to Figure 2 for arranging receiving means to the bottom of the cavity, the billet being shown in partial section,

Figure 4 shows an arrangement of a core in a ready formed billet according to the invention,

Figure 5 shows a side view of an embodiment of a projectile according to the invention with the nose portion finished and the jacket in section,

Figure 6 shows a side view of an embodiment of a projectile core according to the invention, and

Figure 7 shows a back view of the core according to Figure 6.

Figure 5 shows a preferred embodiment of a projectile according to the invention. The projectile comprises a jacket 1 made of a suitable metal, e.g. a copper mixture, and a core 2 arranged in the jacket and made of e.g. steel, hard metal or heavy metal.

A projectile conforming with the invention is made according to Figures 1 to 4 so that a cup-like billet 3 shown in Figure 1 is made of a suitable metal e.g. by lathe work or by forming. The billet is deep drawn such that an essentially cylindrical wall 4 is provided therein in accordance with Figure 2, the wall surrounding a cavity 6 provided with a bottom 5. One end of the billet comprises a base 7, and an opening 8 opening to the cavity is arranged at the other end.

Receiving means 9, such as notches, are arranged at the billet bottom by introducing a pressing tool 10 into the billet through the opening 8. By pressing the tool against the cavity bottom, said receiving means are formed therein.

The manufacture of the projectile continues such that a projectile core 2 according to Figures 6 and 7 is arranged in the billet 3 e.g. by pressing.

A first end of the core comprises a nose 11 and a second end grip means 12. The grip means are e.g. edges or grooves arranged at the end of the projectile. In a preferred embodiment according to Figure 6 and 7, one end of the core 2 comprises eight planar bevels adapted to serve as grip means. The core end comprising the grip means is first directed into the billet 3 cavity 6, whereby the grip means get in contact with the receiving means 9 at the cavity bottom 5 and lock the core in position thus efficiently preventing turning movements of the core relative to the jacket.

Because of the co-operation between the receiving means 9 and the grip means 12, the core always rotates with the jacket 1 when the projectile, forced by the rifling in the barrel of the gun, starts to rotate around its longitudinal axis. In the projectile of the invention, the location of the core 2 is also extremely accurately dimensioned, whereby projectiles made with this method always have a uniform performance upon firing.

Finally the core nose 11 is encased by the billet 3 opening 8 by a method known per se, and the nose portion 13 of the projectile is given the desired shape in accordance with Figure 5.

This way a simple procedure has provided a projectile with a cylindrical jacket 1 wall 4 with accurate dimensions, a base portion 7 with extremely accurate dimensions, and a core 2 arranged in the jacket immobile relative thereto.

According to another embodiment of the invention, the receiving means 9 to be formed at the billet 3 bottom 5 can also be pressed via the core 2. In this case the projectile core, its end comprising grip means 12, is led to the drawn billet 3. The core is pressed against the billet bottom, the grip means bearing against the surroundings of the bottom 5 and forming grooves and simultaneously locking the core end firmly into the jacket base 7. The billet opening 8 is then closed in the manner described above.

It is to be understood that the above description and the related drawings are only intended to illustrate the present invention. Thus the invention is not restricted solely to the embodiment described above or in the claims, but to those skilled in the art many modifications and variations will be apparent within the scope of the inventive idea disclosed in the attached claims.

CLAIMS

1. Method for the manufacture of a projectile comprising a jacket and a core **wherein:-**

- a cup-like billet is made of metal, whereby a jacket is provided by the billet, the jacket comprising a base and an essentially cylindrical wall attached to the base and surrounding a cavity which has a bottom at the end facing the base,

- further, an elongate, essentially cylindrical or polyhedral projectile core is also made of metal, a first end of the core being provided with a tapered nose, and a second end being provided with grip means,

- receiving means for receiving the grip means are arranged in the area of the jacket bottom and the core is arranged in the jacket cavity from an opening in the billet such that the end comprising the grip means is guided to the receiving means receiving the grip means and thereafter the core nose is encapsulated by the jacket end facing the opening, and the projectile nose end is given the desired shape.

2. A method as claimed in claim 1, **wherein the** receiving means for receiving the grip means are formed by pressing the core to the jacket cavity from its opening, whereby the end provided with the grip means is guided to the cavity bottom such that the grim means form the receiving means for receiving the grip means into the area of the bottom.

3. Projectile comprising a core and a surrounding jacket, **wherein the** jacket comprises a base and a cylindrical wall attached to the base and surrounding a cavity, whereby the base end of the cavity comprises a bottom with receiving means, the cavity being provided with an elongate cylindrical or polyhedral core, whereby a first end of the core comprises a nose and a second end comprises grip means arranged in the receiving means at the bottom, and the core nose being encapsulated by the nose portion of the projectile.

4. Projectile as claimed in claim 3, **wherein the** grip means comprise planar bevels formed at one end of the core.

5. Projectile as claimed in claim 3 or 4, **wherein the** the core is of armour penetrating metal.

6. Projectile as claimed in claim 3, 4 or 5, w h e r e i n the cylindrical wall of the jacket is provided by deep drawing from the cup-like billet.

7. Method for the manufacture of a projectile, substantially as herein described with reference to the accompanying drawings.

8. Projectile substantially as herein described with reference to the accompanying drawings.

The Patent Office

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Application No: GB 9715994.1 **Examiner:** R C Squire
Claims searched: 1 to 8 **Date of search:** 15 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F3A; B3A

Int Cl (Ed.6): F42B

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 0520346	TIETIG (see particularly page 2 lines 40-59)	3
X	US 5069139	DENIS (see particularly col.5 line 37 to col.6 line 60)	3-5
X	US 5038684	PETROVICH	3
X	US 4336756	SCHREIBER	3
X	US 3795196	HILLENBRAND (see particularly col.3 lines 9-21)	3,5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.